AMENDMENTS TO THE DRAWINGS

In response to the drawing objection, Fig. 1 has been labeled PRIOR ART.

Attachment: Annotated Sheet (Figs. 1-2)
Replacement Sheets (Figs. 1-2)

REMARKS

Claims 1-27 and 29 directed to a non-elected invention have been canceled without prejudice. Applicant reserves the right to file a divisional application directed to the canceled subject matter.

In response to the objection to the specification, the Abstract has been shortened to meet USPTO guidelines and Fig. 1 has been designated as "PRIOR ART".

Review and reconsideration on the merits are requested.

Claim 28 was rejected under 35 U.S.C. § 102(b) as being anticipated by JP 2003-110140 to Shinya (JP '140).

JP '140 was cited as disclosing the method substantially as claimed, including forming a Cr or Cr alloy contact metal layer through sputtering on an n-type semiconductor layer to attain Ohmic contact without performing annealing (citing paragraphs [0022], [0027], [0033] and Figs. 1 and 2).

Applicant responds as follows.

1. Regarding the present invention:

An object of the present invention is to provide a negative electrode which attains excellent Ohmic contact with an n-type gallium nitride-based compound semiconductor layer and which resists deterioration in characteristics caused by heating (see page 3, lines 20 to 25 of the present specification). Another object of the invention is to provide excellent negative electrode productivity, which attains excellent Ohmic contact with an n-type gallium nitride-based compound semiconductor layer without performing annealing (see page 7, lines 31 to 36 of the present specification).

As an exemplary negative electrode which provides excellent Ohmic contact with a gallium nitride-based compound semiconductor, an electrode formed through vapor deposition of Cr or Cr alloy has been known. However, there is a problem in that when heated, for example, when heated while mounting a flip-chip-type light-emitting device, the characteristics of the negative electrode deteriorate (see page 2, line 27 to page 3, line 17 of the present specification).

The present inventor found that if a layer composed of Cr or Cr alloy is formed on an n-type gallium nitride-based compound semiconductor layer using a vapor deposition method, the characteristics of the resulting negative electrode will deteriorate upon heating after forming the electrodes. However, if the layer composed of Cr or Cr alloy is formed using a sputtering method, the characteristics of the negative electrode remain stable and do not deteriorate upon heating after forming the electrode. Further, the present inventor found that the negative electrode composed of Cr or Cr alloy formed by a sputtering method achieves excellent Ohmic contact with an n-type gallium nitride-based compound semiconductor layer *without the need for annealing*.

2. Comparison of the present invention and the cited reference:

(1) An object of JP '140 is to prevent light extracted from the LED side from being absorbed by the electrodes (see paragraph [0005] of the cited reference). JP '140 proposes an n-electrode having a specific constitution in order to achieve this object. Therefore, the object of the present invention is entirely different from that of JP '140.

(2) JP '140 discloses Cr and Cr alloy as an n-electrode material in contact with an n-type gallium nitride-based compound semiconductor layer. However, they are described as being only one example of eighteen metals and metal alloys (see paragraph [0022] of JP '140).

There is no description or suggestion regarding the problem of deterioration in characteristics when employed as a contact metal layer of an n-electrode upon heating. Of course, there is no description or suggestion that such problem occurs when a Cr or Cr alloy layer is formed using a vapor deposition method. However, this problem does not occur when the Cr or Cr alloy layer is formed using a sputtering method.

A method of forming an n-electrode on an n-type gallium nitride-based compound semiconductor layer is described in paragraph [0027] of JP '140. However, only the description "by using a sputtering apparatus, a vapor deposition apparatus, etc." is found, which suggests that a sputtering apparatus and a vapor deposition apparatus are equal. Also, there is no description as to which apparatus was actually used. Furthermore, the n-electrode material which was actually used was not Cr or Cr alloy, but rather Rh/Al.

Therefore, the cited reference does not suggest the present invention which solves the problem of deterioration in characteristics-upon heating, which occurs when the contact metal layer of the n-electrode is formed using a vapor deposition method, by means of using a sputtering method.

(3) Present claim 28 requires forming the contact metal layer through sputtering Cr or Cr alloy on an n-type semiconductor layer to attain ohmic contact without performing annealing. The subject limitation is not met by JP '140 such that claim 28 defines novel subject matter.

Particularly, in reference to Paragraph [0022], 11a constituting the negative electrode may be Cr or CrAl alloy. Further, paragraph [0022] discloses that after forming the first region (i.e., 11a constituting the negative electrode) better Ohmic characteristics can be acquired *by performing annealing*. That is, paragraph [0022] does not describe forming the contact metal layer *through sputtering* and *without performing annealing*. Rather, the subject passage

indicates that the inventors of JP '140 did not recognize that Ohmic contact could be achieved without performing annealing, which is a characteristic feature of the invention.

The Examiner also cited paragraph [0027] as disclosing that the n-type contact layer may be formed using a sputtering system. Specifically, paragraph [0027] describes sputtering of an n-type contact layer made of an Rh/Al alloy *followed by annealing*. Thus, paragraph [0027] of JP '140 does not disclose forming a *Cr or a Cr alloy* contact metal layer, does not describe forming the contact metal layer *through sintering*, and does not disclose forming a Cr or Cr alloy contact by sputtering to attain Ohmic contact *without annealing*. In view of the above-noted differences, it is respectfully submitted that claim 28 is not anticipated by JP '140. Although in various unrelated passages, JP '140 may disclose a Cr or a Cr alloy constituting a contact metal layer, and in certain other passages JP '140 may describe sputtering, there is no specific description of sputtering Cr or a Cr alloy on an n-type semiconductor layer to form a contact metal layer, and there surely is no specific description of forming such contact metal layer *without performing annealing* as required by present claim 28.

With respect to any underlying obviousness rejection under §103(a), paragraph [0027] of JP '140 discloses that either vapor deposition or sputtering can be used to form the n-type contact layer, such that the inventors of JP '140 did not recognize that when the contact metal layer is formed through vapor deposition followed by annealing, the film exhibits Schottky contact characteristics and impaired resistance value (page 19, lines 9-14 of the present specification). In contrast, according to the present invention, the film formed through sputtering exhibits Ohmic contact characteristics without performing annealing.

Because the machine translation is somewhat difficult to read, Applicant submits herewith an English translation of paragraphs [0005], [0006], [0022] and [0027] of JP '140 for the Examiner's review and consideration.

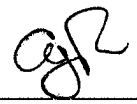
It is respectfully submitted that claim 28 is not anticipated by JP '140, and withdrawal of the foregoing rejection under 35 U.S.C. § 102(b) is respectfully requested.

Withdrawal of all rejections and allowance of claim 28 is earnestly solicited.

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington, D.C. telephone number indicated below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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